10-24-83

DuBOIS & KING, INC.

ENGINEERING • PLANNING • DEVELOPMENT • MANAGEMENT

Box 339
Randolph, Vermont 05060-0339
(802) 728-3376
Telex No. 469141

82821
October 24, 1983

F. M. DONOVAN

OCT 30 1983

Aerojet Investments, Ltd.

Mr. Frank M. Donovan, President
Aerojet Investments, Ltd.
10300 North Torrey Pines Road
La Jolla, California 92037

SUBJECT: Groundwater Monitoring Results

Dear Frank:

DuBois & King, Inc. is pleased to submit the enclosed results concerning water quality in the vicinity of the former Howe-Richardson Scale Company plant in Rutland, Vermont.

I believe that you will find the report is straight forward and self explanatory. The overall water quality appears to be consistent with what was measured in 1980 and 1981. However, please feel free to contact me with any comments and/or questions you may have.

An invoice will be submitted at the end of the month per our Letter Agreement. We are pleased that you requested our services and look forward to being of assistance in the future.

Very truly yours,

DuBois & King, Inc.

John F. Amadon
Laboratory Director

JFA/pal
Enclosure

August, 1983
Water Quality Monitoring
at the former
Howe-Richardson Scale Co. Facility
in Rutland, Vermont

Prepared by
J.F. Amadon, Laboratory Director
DuBois & King, Inc.
October 12, 1983

Background Information

During 1980 and 1981, when the Howe-Richardson facility was still operational, several water quality monitoring programs were performed by DuBois & King, Inc. in conjunction with the Howe-Richardson staff. These reports have been previously submitted to the Howe-Richardson Scale Company. In essence, a series of groundwater monitoring wells were installed to evaluate the influence of former waste disposal practices on both the groundwaters and the surface waters of Moon Brook. Figure 1 illustrates the locations of the monitoring wells relative to the plant layout. Monitoring Well (MW) numbers 1 through 5 were installed in April of 1980. The MW's 6, 7 & 8 were installed in June of 1980 to provide additional data. The MW's 9 through 13 were installed following the verification of oil contamination from the underground storage tanks in April of 1980. The wells were constructed of slotted 1-1/2 inch PVC wrapped in Mirafi filter fabric. No solvent cement was utilized in well construction.

The direction of groundwater flow from the facility was determined to be towards Moon Brook. Therefore, upgradient and downgradient samples of Moon Brook were also taken for analyses. These sampling locations are at the railroad overpass northeast of the property and at the railroad overpall southwest of the property respectively. The last series of analyses from any of the sampling locations was performed in October, 1981 and the results were submitted to the Howe-Richardson Scale Company.

Current Monitoring Program

On August 24, 1983, J.F. Amadon of DuBois & King, Inc. met onsite with F. M. Donovan, R.B. O'Brien, both of the Aerojet Corporation, and with several former employees of the Rutland Facility. Following a review of the 1980 and 1981 available data it was decided to evaluate the waters in all existing wells and in Moon Brook.

It is important to note that MW6 could not be found. The entire area in the vicinity of MW's 4,6,7, & 8 had been 'cleaned up' of the surface waste materials that had been present when the facility was operational. Apparently MW 6 was demolished during this clean up phase. In addition, the downgradient sample from Moon Brook was taken approximately 200 yards below the southwest railroad overpass at the same location as the additional June 25, 1981 sample. The location is just upstream of some refuse in the Brook including an old refrigerator.

On August 24, 1983 the static water level in each well was measured from the top of the well casing (TOC). The depth to the bottom of the wells was also measured to calculate the water volume in each well to assure that an adequate volume of water was removed in the well purging process. Purging the wells of stagnant water was performed by peristaltic pumping. The transmissivity of water through the soils was sufficiently low that all the wells were pumped to dryness. Within 30 minutes after drawing down a well, sufficient waters had collected in the wells to allow a sample to be withdrawn by peristaltic pumping for onsite pH and specific conductance determinations.

On August 25, 1983 samples were obtained from the monitoring wells and Moon Brook for analyses. For MW's 1,2,3,4,5,7 & 8 the static water level was measured from the TOC. Samples for volatile organics were then obtained with a bailer constructed of PVC and glass. There were no solvent cements utilized in the bailer and samples were deposited in 40 ml glass vials with teflon caps and no headspace. Duplicate samples were obtained from each well. In addition, a second duplicate set of volatile organics was sampled for Dick O'Brien from MW4, MW7, downgradient Moon Brook, and a field blank. Following collection of the volatile organics sample, each well was sampled by peristaltic pumping. The samples were filtered onsite through .45 micron glass filter paper and aliquots preserved by chilling and by nitric acid for heavy metals analyses. The pH and specific conductance were measured onsite.

Also, on August 25, 1983 the MW's 9 through 13 were sampled following a measurement of the static water level from the TOC. Again, a PVC bailer was utilized to obtain samples for the 40 ml teflon capped glass vials. Additionally, peristaltic pumping provided samples for onsite pH and specific conductance measurements.

Results of Onsite Measurements

The results of the onsite measurements are presented in Table 1. Based on both the static water levels measured on August 24, 1983 and the relative elevations of the tops of the well casings it appears that the direction of the groundwater flow remains toward Moon Brook (Figures 2 and 3).

Following the purging or water drawdown of the wells on August 24, 1983, samples were taken of the initial waters refilling the wells. Both pH and specific conductance measurements were recorded. On August 25, 1983 when samples were obtained for the analytical work, both pH and conductivity were again measured. There was little difference between the 2 day's measurements for each well. This indicates that the samples taken for analysis were representative of the aquifer and that the well purging/drawdown procedure was sufficient for removing the stagnant well waters.

The rate of well refilling following drawdown was slow. However, the static water levels measured on August 25, 1983 indicate that recovery was essentially complete.

Analytical Results of General Water Quality

The pH and specific conductivity results were presented in Table 1 and the remaining current analytical results are presented in Table 2. With respect to the pH and specific conductivities for test wells 1 through 8 and Moon Brook, the results appear comparable to those generated in 1980 and 1981. This is further illustrated in Table 3 where the comparisons can be readily made between the three years. While the specific conductance is significantly higher in some wells than others, it has remained essentially constant and does not appear to affect the specific conductance of Moon Brook downgradient from the property. With respect to pH, there has been an overall decrease in all sampling locations and again, there appears to be no affect of former facility practices on the pH of Moon Brook. The overall pH decrease seen from 1980 to 1983 is probably a function of other external factors and is evidenced in the upgradient Moon Brook sampling as well.

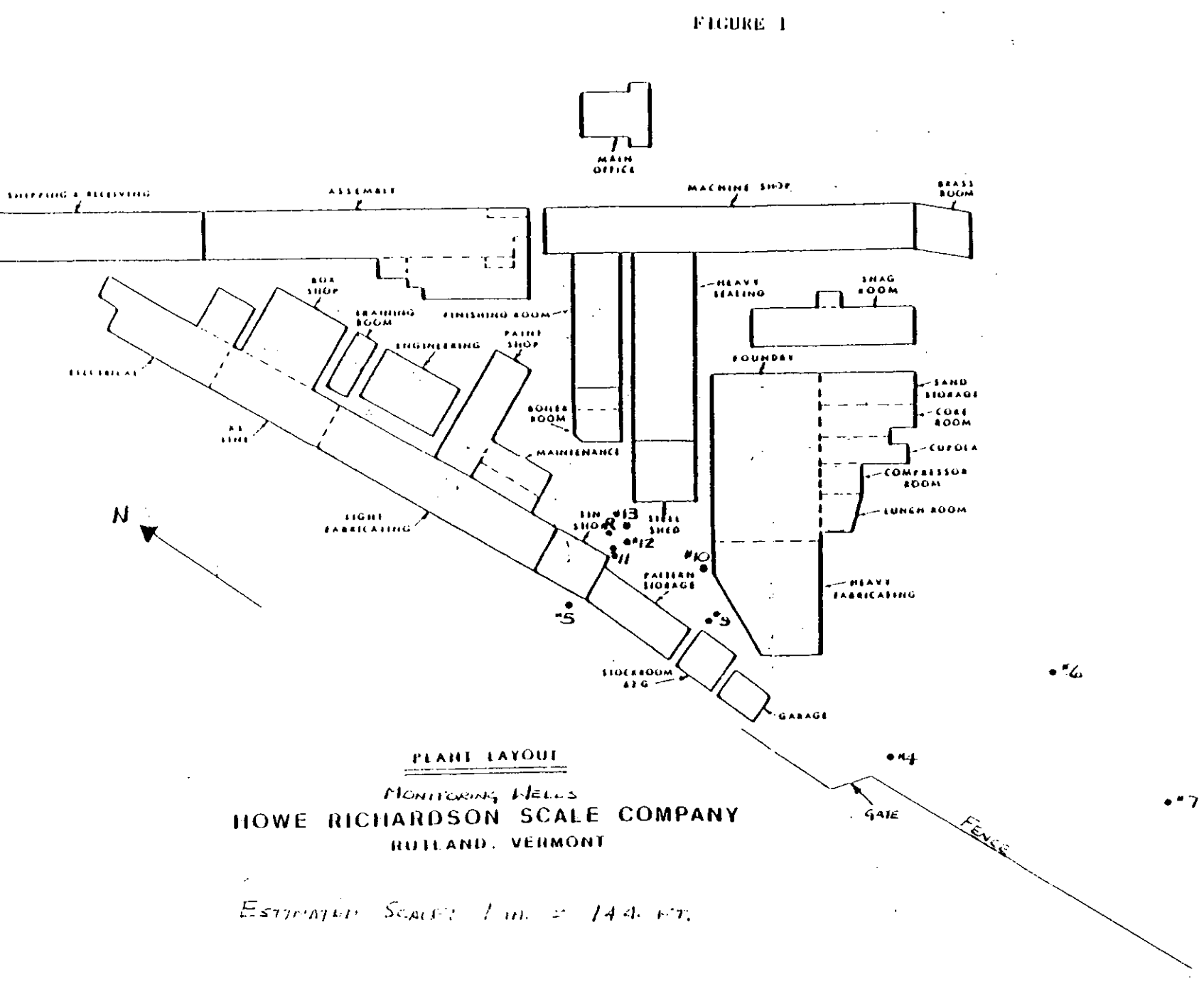
The other inorganic parameters currently assayed were iron, zinc and chromium. Following a review and onsite discussion of the 1980 and 1981 water quality data a decision was made to limit the current round of analyses to pH, conductivity and these three heavy metals. The metals analyses were performed by atomic absorption spectroscopy on the field filtered, nitric acid preserved samples. The results are presented in Table 2 and comparatively in Table 3. It is clear that Moon Brook is not being and has not been adversely affected by these metals. It is also clear that with time, the iron and zinc contents in the groundwater monitoring wells have decreased. The chromium levels since June 10, 1980 have consistently been below 0.02 mg/l, less than the 0.05 mg/l threshold level of the Safe Drinking Water primary standard.

The concern about these three metals arises from the water quality data generated on April 2, 1980 where iron, zinc and chromium levels in 4 groundwater samples were as high as 1,237., 3.75, and 7.64 mg/l respectively. As illustrated in Table 3 the metals contents never again approached these levels. In reviewing the historical background, the groundwater monitoring wells 1,2,3, and 4 were installed on March 31 and April 1, 1980. These wells were then sampled on April 2, 1980. It is highly probable that the excessive metals measured in the 4/2/80 samples were a function of well construction contamination and were not representative of the true metalic concentrations in the groundwater. Therefore, it appears that there is not an adverse affect on water quality due to these heavy metals.

In addition to the inorganic constituents, samples of Moon Brook and monitoring wells 1 through 8 were assayed for volatile organics by GC/MS (gas chromatography/mass spectrometry). These results are presented in Table 2. All priority pollutant volatile constituents detected in one or more samples are presented. The results show that there appears to be no adverse affect on Moon Brook but also that some of the monitoring wells still show evidence of chlorinated and reduced ethane compounds. This is especially true for MW4 where the dichloro substitued compounds have increased since 1980 and 1981 but trichloro compounds have decreased. Table 4 illustrates the apparent historical trends for the di and tri chlorinated ethane compounds. However, it should be pointed out that for the 3 discrete sampling times, 3 separate organic laboratories performed the analyses. In addition, it should be pointed out that the 1981 report discusses results in mg/l which should have read ug/l as it was in the 1981 results sheet.

Based on the results of the fuel oil analyses (Table 2; MW5 and MW9-13) it appears that no residual fuel oil from the 1980 storage tank leak is reaching the groundwaters. No fuel oil was found in any of the monitoring well samples (detection limit 0.1 mg/l). However, water drawn off from the recovery well contained 8.8 mg/l of fuel oil in solution. This concentration does not take into account the black, heavy, floating petroleum product. Because of the presence of this material in the recovery well (R on Figure 1) and its location with respect to the groundwater (static level 5.45' below TOC), recovery operations should be continued. In addition, it is recommended that the monitoring program be continued on at least a yearly basis for the static water levels, pH, specific conductance, volatile organics and fuel oil scan.

FIGURE 1



PLANT LAYOUT

Monitoring Wells

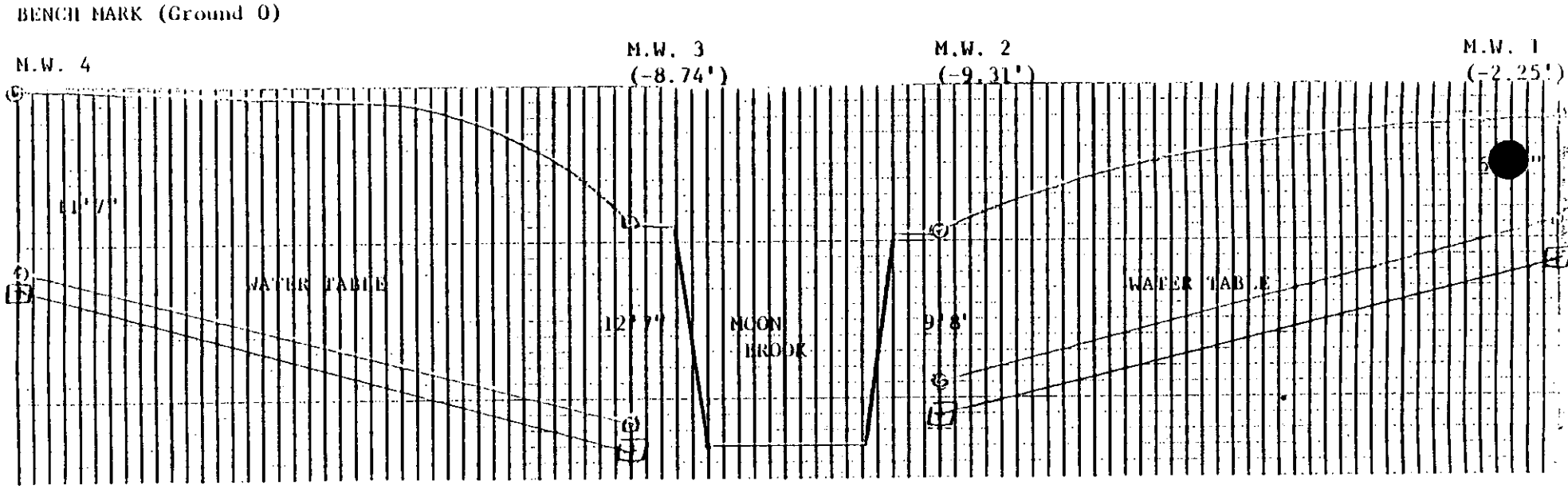
HOWE RICHARDSON SCALE COMPANY

RUTLAND, VERMONT

Estimated Scale: 1 in. = 144 ft.

FIGURE 2:

TOPOGRAPHICAL SKETCH (X-SEC)
and GROUNDWATER LEVELS

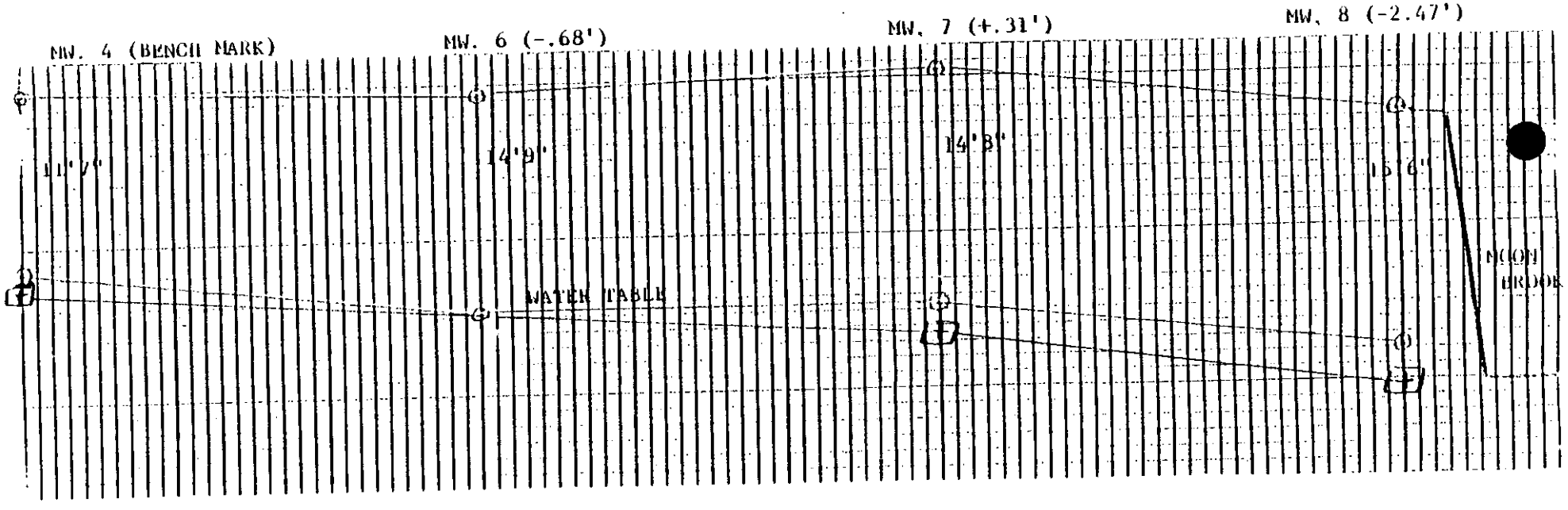


MONITORING WELLS

	TOPOGRAPHY	WATER TABLE (From Surface) (f) June, 1980	(+) August, 1983
4.	(Bench Mark, Ground 0)	11'7"	12.9'
1.	-2.25'	6'10"	9.1'
2.	-9.31'	9'8"	11.3'
3.	-8.74'	12'7"	14.6'

(Distance between wells and land curvature not to scale)

FIGURE 3:



MONITORING WELLS

TOPOGRAPHY

4. (Bench Mark), Ground 0
5. Not Included
6. -.68'
7. +.31'
8. -2.47'

WATER TABLE (From Surface)

⊕ June, 1980	⊞ August, 1983
11'7"	12.9'
4'0"	4.8'
14'9"	–
14'8"	16.4'
15'6"	18.15'

(Distance Between wells and land curvature not to scale)

TABLE 1

Onsite Measurements of the August, 1983
Groundwater Monitoring Program at the
Former Howe-Richardson Facility in
Rutland, Vermont

Well #	depth (ft) from TOC* to bottom of water column		8/24/83 water level		8/25/83 water level	Specific Conductance 8/24/83 umhos/cm	Specific Conductance 8/25/83 umhos/cm	pH 8/24/83	pH 8/25/83
				H_2O Depth					
1	20.05	—	9.1 =	10.15'	9.05	790	840	7.2	7.05
2	19.4	—	11.3 =	8.10'	11.30	770	770	6.8	6.75
3	18.4	—	14.6 =	2.80'	14.9	620	600	6.9	6.8
4	29.2	—	12.9 =	16.30'	13.4	975	1190	7.0	7.2
5	11.05	—	4.8 =	6.25'	5.7	420	870	7.15	7.2
7	29.8	—	16.4 =	13.4	16.35	640	630	7.6	7.6
8	29.55	—	18.15 =	11.4	18.4	1260	1240	7.3	7.1
9	24.5	—	7.4 =	17.1	7.3	630	630	7.4	7.3
10	24.8	—	6.2 =	18.6	6.15	1070	1220	6.8	7.1
11	24.15	—	5.4 =	18.75	5.45	1350	1320	7.2	7.25
12	4.9	—	2.8 =	2.1	2.95	204	191	6.65	6.95
13	24.6	—	5.1 =	19.5	5.1	376	370	7.25	7.2
Moon Brook-upstream			--		--	--	340	--	7.2
Moon Brook-downstream			--		--	--	320	--	7.2

* TOC - Top of the well casing

TABLE 2

Analytical Results of the August, 1983
Groundwater Monitoring Program at the
Former Howe-Richardson Facility in
Rutland, Vermont*

Well No.	Fe mg/l	Zn mg/l	Cr mg/l	Residual fuel oil (mg/l)	Perchloro-ethylene (ug/l)	1,1,1-trichloro ethane (ug/l)	1,1 dichloro ethene (ug/l)	1,1 dichloro-ethane (ug/l)	1,2 dichloro-ethane (ug/l)
1	0.16	0.040	0.0004	---	nd	nd	nd	nd	nd
2	0.33	0.044	<0.0004	---	<5	nd	nd	nd	nd
3	0.30	0.085	0.0043	---	nd	nd	nd	nd	nd
4	0.17	0.032	<0.0004	---	nd	84	430	600	9
5	0.14	0.032	0.0027	---	<5	nd	nd	nd	nd
7	0.13	0.028	0.0026	0.1	nd	nd	nd	77	nd
8	0.09	0.036	0.0012	---	nd	nd	nd	<5	nd
9	---	---	---	0.1	---	---	---	---	---
10	---	---	---	0.1	---	---	---	---	---
11	---	---	---	0.1	---	---	---	---	---
12	---	---	---	0.1	---	---	---	---	---
13	---	---	---	0.1	---	---	---	---	---
Moon Up	0.29	<0.005	0.0014	---	nd	nd	nd	nd	nd
Moon Down	0.30	<0.005	0.0016	---	<5	nd	nd	nd	nd

Well #	Carbon Disulfide (ug/l)	Chloroform (ug/l)	Bromomethane (ug/l)	Methylene Chloride (ug/l)	Acetone (ug/l)	Freon (ug/l)
1	nd	nd	nd	nd	<100	ng
2	nd	nd	nd	18	<100	12
3	nd	nd	nd	nd	nd	nd
4	nd	<5	nd	nd	nd	nd
5	11	nd	nd	15	nd	nd
7	nd	nd	nd	7	<100	8
8	nd	nd	nd	nd	<100	5
Moon-up	nd	<5	nd	nd	nd	nd
Moon-down	nd	nd	<10	nd	<100	10

* The symbol --- means the analysis was not performed, nd means the compound was not detected, and < means the compound was detected but at less than the reportable detection limit for the analytical procedure.

TABLE 3

Comparisons of Some Inorganic Water Quality Constituents with Time at the Former Howe-Richardson Facility in Rutland, Vermont

Well #	Conductivity (umhos/cm)			pH (Su)			Iron (mg/l)			Zinc (mg/l)		
	6/10/80	6/25/81	8/25/83	6/10/80	6/25/81	6/25/83	6/10/80	6/25/81	6/25/83	6/10/80	6/25/81	6/25/83
1	840	830	840	7.4	7.1	7.05	1.25	0.29	0.16	0.094	0.071	0.04
2	440	760	770	7.4	7.1	6.75	2.90	1.80	0.33	0.113	0.072	0.044
3	730	450	600	7.25	7.0	6.8	7.80	0.42	0.30	0.106	0.135	0.085
4	960	1220	1190	7.75	7.7	7.2	0.75	0.27	0.17	0.083	0.078	0.032
5	950	980	870	7.4	7.1	7.15	1.57	0.09	0.14	0.152	0.065	0.032
6	830	780	--	7.35	7.5	--	0.42	2.70	--	0.110	0.103	--
7	630	640	630	7.9	7.8	7.6	0.29	0.07	0.13	0.056	0.058	0.028
8	1220	1270	1240	7.75	7.8	7.3	0.59	0.09	0.09	0.170	0.143	0.036
Moon-up	310	400	340	8.1	7.9	7.2	0.27	0.31	0.29	<0.05	<0.005	<0.005
Moon-down	310	370	320	8.1	7.8	7.2	0.30	0.35	0.30	<0.05	<0.005	<0.005

Well #	Chromium (mg/l)		
	6/10/80	6/25/80	8/25/83
1	<0.02	<0.02	0.0004
2	<0.02	<0.02	<0.0004
3	<0.02	<0.02	0.0043
4	<0.02	<0.02	<0.0004
5	<0.02	<0.02	0.0027
6	<0.02	<0.02	---
7	<0.02	<0.02	0.0026
8	<0.02	<0.02	0.0012
Moon-up	<0.02	<0.02	0.0014
Moon-down	<0.02	<0.02	0.0016

TABLE 4

Comparisons of Some Organic Water Quality Constituents with Time at the Former Howe-Richardson Facility in Rutland, Vermont

Well #	1,1,1 - Trichloroethane (ug/l)			Dichloroethane (ug/l)			Dichloroethylene (ug/l)		
	6/10/80	6/25/81	8/25/83	6/10/80	6/25/81	8/25/83	6/10/80	6/25/81	8/25/83
1	59.6	< 2.	< 5.	< 5.	< 5.	< 5.	6.	< 5.	< 5.
2	22.	< 2.	< 5.	< 5.	< 5.	< 5.	3.	< 5.	< 5.
3	39.6	< 2.	< 5.	< 5.	< 5.	< 5.	6.	< 5.	< 5.
4	17.	120.	84.	108	< 5.	609.	60.	< 5.	430.
5	20.	< 2.	< 5.	< 5.	< 5.	< 5.	6.	< 5.	< 5.
6	230.	360.	--	5.	< 5.	--	12.	< 5.	--
7	93.	78.	< 5.	24	< 5.	77.	6.	< 5.	< 5.
8	7.	< 2.	< 5.	< 5.	< 5.	< 5.	5.	< 5.	< 5.
Moon-up	20.6	< 2.	< 5.	< 5.	< 5.	< 5.	5.	< 5.	< 5.
Moon-down	25.	< 2.	< 5.	< 5.	< 5.	< 5.	3.	< 5.	< 5.